Low Optical Depth Features in Saturn's Rings: The Occultation of GSC5249-01240 by Saturn and Its Rings

A. S. Bosh, C. B. Olkin (Lowell Obs)

On 21 November 1995, Saturn and its rings occulted the star GSC5249-01240 (Bosh & McDonald 1992, *Astron. J.* **103**, 983). Although the star is relatively faint (V = 11.9), other circumstances conspired to make this an excellent event: (i) the normally-bright rings were dark because the sun was crossing through the ring plane, reducing the amount of ring contribution to the background noise and therefore increasing the observed S/N, (ii) the ring opening angle was small ($B \sim 3^\circ$), enhancing detection of low-optical-depth material, and (iii) the low sky-plane velocity allowed longer integration times without loss of spatial resolution. Thus this occultation was particularly well-suited to produce high S/N detections of low-τ ring material.

We observed this atmosphere and ring occultation with the Faint Object Spectrograph (FOS) on the Hubble Space Telescope. Using the FOS in its high-speed mode, we sampled the starlight with the G650L grating, recording the stellar signal as a function of both wavelength and time. For the initial analysis of these data, the spectral information was sacrificed by binning all wavelengths together; this in turn increased the detected S/N. We performed a geometric solution for the event, using the known locations of circular ring features as fiducials (Elliot et al., *Astron. J.* **106**, 2544). The scattered light from Saturn and the rings was modelled and subtracted from the light curves to obtain line-of-sight optical depth as a function of ring-plane radius.

With these processed data we have made the first occultation detection of Saturn's innermost and very tenuous D ring. We find a line-of-sight optical depth for the thickest part of this ring of $\tau_{obs} \sim 0.02$. The location and morphology of this feature will be discussed. Comparison of the observed structure will be made with the previous Voyager imaging detection of this ring (Smith et al. 1981, *Science* **212**, 163; Marley & Porco 1993, *Icarus* **106**, 508).

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Paper presented by Amanda S. Bosh
Lowell Observatory
1400 W. Mars Hill Road

Flagstaff AZ 86001-4499 USA
Phone: 520-774-3358
Fax: 520-774-6296
Email: amanda@lowell.edu

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